

**Food Packaging Technology**  
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**Week – 08**  
**Lecture – 40**

**Bottling Machine - Part 2**

Hello everyone. Welcome to another session in the module 5 of the Food Packaging Technology course. Last class we were dealing with the bottling machines and we'll be continuing with that in this session. A quick recap. We talked how bottling process includes all the sophisticated automatic machineries lined up one in series. These bottlers will move from the feeding to the final transportation section.

So, going through that, we had the bottlefeeding section, bottle cleaning, filling, closing, labelling and final collating and transportation. We were talking about the different fillers and we talked about liquid fillers and solid fillers. In liquid fillers, we talked about how the liquid will be filled to a predetermined level or it may be measured dosing. And the predetermined level we had the vacuum filling, gravity, pressure and level sensing.

We also talked about solid fillers where solids can be filled in the form of granules or as powders as volumetric, weight or counting methods. We had already covered the volumetric method where we talked about vacuum filling, flask and the auger filling method. Today we'll continue with the other methods of solid fillers and the other remaining methods for bottling. Now, other than volume, a very common method of filling powders into sachets or packaging material is by weight. This is one of the best methods to meet the regulations of regulatory bodies.

Here, we use a single or double action scale beams or heads. And here the operation or the way in which these products are put into the filling machines is operated either by the compressed air or electronic or microprocessor control systems. This is another pictographic representation of this. You have the product and powders or granules in the vibrator field. It goes into a control box which directs it into the weigh pan.

The weighing pan weighs the amount that is to be filled and that goes into the packaging. One of the basic principle here, is they usually divide the supply of the product into two fields. Here you can see it as bulk feed and the fine feed. Now the bulk feed, at the beginning both bulk feed and the fine feed works till the package is filled to

about 90% of the required material. Now once they have reached 90% of the required material in the package, the bulk feed stops and then they will have this dribble feed that is fed from the fine feed till you reach the weight that you require.

This helps to ensure that you have almost the correct weight that you require. No overfilling and no underfilling. So once the fine feed stops, the load is discharged by tipping into the container. That's the way they usually do it. In a packaging line, it's important to maintain a statistical record.

You know, periodically measure and see if the weights are being added properly or in volume also. Whether it's volume or weight, it is being added in the correct measure. So, in statistical recording, there is a need to maintain adequate statistical records of the packaged weight. So, it's just a manual quality control where you will periodically weigh the materials and see if it is being maintained. If there is a deviation, you will see what is the rate at which the deviation takes place.

There is also automated quality control check where they will keep a simple weight checking machine. And suppose the weight is underfilled, it will be rejected or else it will pass. And this picture here shows a simple method in which you can maintain this. You have a feeding option here. You have the control.

Once it is filled, it goes in, it is manually checked. If it does not meet the requirements, it's rejected or it is passed. But on the other hand, if it's an automated quick check, you will have a weight checking in between which is regularly weighing the filled packages. So, in the beginning, there will be a tare weight is taken and this weight is once made zero, then the package is filled, it goes in. And periodically the weight is checked.

Again, it's rejected if it doesn't meet the requirements or it is passed through. There is another method in which the container is first tare weight, that is it's made zero. And it is transferred to the bulk filling station. And here maximum amount of the product is added at high speed. Now this partly or almost completely filled container is transferred to a second weighing station.

Using a computer system, they will record the weight and the amount of product that is needed to attain the final weight. And this required remaining weight is transferred to the fine filling head. Now the package goes into the fine filling head and the required amount is added. And again, the weight is taken. Final weight is taken to ensure that the correct thing has been done.

Now there is an advantage of doing this so that you will see that statistically you will have less errors and it is no overfilling is done. This is a diagrammatic representation of this fully controlled system. Like I told you, you will have the bulk filling in the beginning where the package is tared. You will add the product by bulk filling quickly to almost full. Then it goes into the weighing scale.

It's checked. The remaining weight is added through the fine cell. And again, it's checked if it meets the requirement, it is passed. Otherwise, it is rejected and taken back again. Coming to the next step. So, we talked about filling the bottles or the jars or the containers with your product.

The last step will be capping it. Capping it or sealing is very important so that the product is secured, second there is no spill and the shelf life is increased. For speeds up to 60 per minute, cap tightening alone is enough. The fill containers with the preformed screw caps, it is loosely applied first and then either manually or automatically there will be a rubber-lined chuck which will seal it completely. But, in bottling lines which have speed of operating at more than 60 per minute, we have an automated capping machine.

Here usually, they first have a cap unscrambler just like you had a bottle unscrambler. There was a cap and scrambler which will deliver the caps one by one for the feeding caps and then the machine is the one that will securely tighten it over the bottles. Now when you can transfer the caps from this cap chute to the bottle is done by two methods. 1) the bottle picks up the cap as they pass through the end of the chute.

That's one method. The chute will deliver it onto the bottle. 2) there is a transfer arm which is attached to the rotary strip and that takes the cap from the chute, feeds it onto the bottle and caps it individually. So, this capping machine can be divided into different parts. You have automatic capping machine, roll on capping, corking and plugging or crown caps. I am sure you all are familiar with each of these caps though the terms may not be very familiar.

Let's look at that one by one. We start with the automated capping machine which is divided into the inline cappers and the rotary cappers. So, as we saw the automatic capping machines can be divided into the in-liner cappers and the rotary cappers. So, in-liner cappers is actually a simpler method. The bottles are conveyed on the conveying belt and the cap is directly attached to them on another conveyor belt on top of it.

And the operating speeds are around 450 bottles per minute. On the other hand, rotary cappers is more sophisticated. Individually, the containers are held while the

rotating chuck screws will put the caps on them. This is and for plastics and delicate caps generally they use pneumatic chucks where they will have air turning it on rather than having a pressure. The picture here is showing the linear screw capping machine.

There is something else called a roll-on capping. This is widely used. You must have seen the threads on the caps. So these threads are formed by the rotating heads while the cap is in position on the bottles. The addition that you can put which is called ROPP which is the roll-on pilfer proof.

Now pilfer proof as you will remember is tamper proof. So, when you can incorporate the ROPP into your bottling, what happens is in case this is removed, it breaks a series of perforations and this is evidence for tampering. So, this ROPP can be incorporated in the capping procedure itself. Another method is the corking and plugging. One of the capping methods is to screw it on, another one is corking it.

You must have seen corks in many of these bottles of wine where the cork is pushed in. Here the cork or the plug, it's actually there is an unscrambling hopper which will deliver them one by one into a chuck. And the chuck is the one that pushes these corks into the bottle opening by a downward thrust. Sometimes they are given one or more two blows to the cork so that it is tightly attached to the bottles and the sealing is secure. A third type which you must have seen in many of the carbonated beverages is the crown corks.

The crown corks, if you have noticed, underneath these crown corks, they have a liner, it's called a wad. They keep that extra airtight seal. This is usually used in beer bottles, usually used in bottling lines which operates at a speed of 600 per minute. Here pressure is exerted on the crown and that pushes the wad or the liner into the top portion of the bottle. And, then there is this clinching head which will crimp it and the corrugated skirt is pushed into the groove of the bottle.

Corrugated skirt is what you see on these caps, that is why it's called a crown cork. This kind of corking or crown corks can withstand internal pressure up to 100 psi. So, you dealt with bottle feeding, cleaning, we saw the different types of filling, both liquid filling and solid filling. Closing, using three types of closures and we will move on to labelling. In labelling, up to speeds of 60 per minute, semi-automatic labelling machines can be used.

That's enough. But in higher amounts, you might have to go for automated labelling. Here the labels are glued and applied directly on to the package. There are three ways in which the labels can be applied. 1) the adhesive is applied on to the label

while it is held under a vacuum pad and then that is attached to the package. 2) the adhesive is applied to a plate and it is the plate that applies the adhesive to the label and that is glued to the package.

Third way is the bottle itself receives the pattern of adhesive and the label is attached. This gives a pictographic representation of a bottle labelling machine. So, we have gone through the bottle feeding, bottle cleaning, filling, closing, labelling. The last part is the collating and packing for the transportation. The filled cans or the bottles, they are packed in fibre boards.

You must have seen how they are usually done manually. But if there is high speed of 120 per minute, automatic case packing is there, you must have seen corrugated fibre boards containing glass bottles which have got cardboard dividers in them. This is mainly to prevent breakage between the glass bottles during shipment or transportation. So, when these dividers are required, the glass bottles are packed, there is a drop packer and this collates the bottles and drops them into the case with the dividers that are already fitted. And then it moves on to the gluer which glues the flaps and the case is moved to a compression section where the adhesive is allowed to sit.

Now the whole thing is ready to be packed and ready for shipment. There is another alternative method of this which is the wrap around method. We have already learnt about the shrink wrapping and the stretch wrapping. This actually collates or unites the different bottles under one wrap. Dividers can be added if it is required, especially if they are delicate and can be broken.

Now the shrink or stretch wrap, the one that you see here is the stretch wrap around drinking bottles. Now these are applicable to all kinds of foodstuffs. It is wrapped loosely around the whole package and then it is taken into a heated tunnel. The heat shrinks the packaging material and that takes the shape of the product, envelops it and keeps it secure. The stretch wrap on the other hand, it is stretchable.

So the film is tensioned around the whole unit, there is no heat required and it helps in unitizing it. If you want to pack bottles, it can either be done in a corrugated fibre board or the wrap around method. Both of these are very much used today. One of the last steps is palletizing it. That is you keep them onto pallets and this helps in stacking or storing it in the warehouses.

These pallets itself, they are flat platforms as you can see here also. They usually have a space in the lower and upper half. So this forklift can actually take it up and push it into the shipment or the trucks. The pallet loads are usually cubicle in shape. It can be

again wrapped around which is stretch pack, which colletizes.

Manual loading is usually most common but if it is a higher output, higher production area, you can use your automated palletizing equipment. Now like I said, the shrink or the stretch wrapping is very much common nowadays. So a quick recap, we talked about bottling lines. We talked about both liquid fillers and the solid fillers. Both of them, liquids are usually filled in volume, predetermined level or in measured dosing.

When you fill it, you can either have it in vacuum, gravity, pressure or level sensing. Solid fillers on the other hand, may be powders or granules. Again, we fill this volume. These volumetric fillers itself can be divided as under vacuum, auger or the flask method.

Most common for solids is the weight method. There you can either have a net or the gross weight. Counting again for solid fillers can be used for products where you count the number of products that need to be there in a package. Maybe either electronic or mechanical. We also talked about capping different methods for capping machines. You have the automatic capping machine, roll-on capping machine which includes the ROPP, corking and plugging and the crown corks.

So, with that we have come to the end of bottling machines. I will continue in the next class with carton making machines and packaging printing machines. Thank you.